THE PEARCE-SELLARDS *Series*

NUMBER 18

Early Tertiary Vertebrate Faunas, Vieja Group, Trans-Pecos Texas: Equidae

Part 1. *EPIHIPPUS* FROM THE VIEJA GROUP, TRANS-PECOS TEXAS

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Part 2. *MESOHIPPUS* FROM THE VIEJA GROUP, TRANS-PECOS TEXAS

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Part 3. COMPARISON OF POPULATIONS OF *MESOHIPPUS* FROM TRANS-PECOS TEXAS AND THE BIG BADLANDS, SOUTH DAKOTA

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Part 1. *Epihippus* from the Vieja Group, Trans-Pecos Texas

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INTRODUCTION

In the collection of the Texas Memorial Museum,* The University of Texas at Austin, there is a small sample of fossil horse bones intermediate in size between the Uintan *Epihippus gracilis* Marsh and the Duchesnean *E. intermedius* Peterson. The specimens belong to the Candelaria local fauna of the Colmena Tuff Formation of the Vieja Group; the fauna was recently assigned to the Uintan Age (Wilson *et al.*, 1968). This is the southernmost record of the genus *Epihippus*.

ABBREVIATIONS

@	approximate
ant W	anterior width
b	coefficient of regression
FMNH	Field Museum of Natural History, Chicago, Ill.
L	greatest length
M	mean
N	total sample size
OR	observed range
OU	University of Oklahoma Museum, Norman, Oklahoma
post W	posterior width
r	coefficient of correlation
TMM	Texas Memorial Museum, The University of Texas at Austin

All measurement are in millimeters and in Part 2, table 1 shows maximum values.

Systematic Paleontology

Family Equidae

Epihippus Marsh 1877

Epihippus cf. *E. gracilis* (Marsh), 1871

Figs. 1, 2, Table 1

Material.—TMM 40276–20, L. P_2 and jaw with L. P_4–M_2; 40497–3, L. P_4–M_3, and R. M_3; 40630–10, fragmentary right upper molar.

* This collection and the Vertebrate Paleontology Laboratory were formerly under the administrative control of the Bureau of Economic Geology. They were transferred to the Texas Memorial Museum, The University of Texas at Austin, in November, 1969.

Stratigraphic position.—Lower 50 ft. Colmena Tuff Formation, Vieja Group, Presidio County, Texas.* Candelaria local fauna, Uintan, Late Eocene (Wilson *et al.*, 1968).

Description.—P_2 is very small. The protoconid is high and pointed. There is no sign of an incipient metaconid budding off postero-lingually, but there is a ridge running down from the tip of the protoconid to the base of the entoconid. The paralophid is short and very slightly curved lingually. The entoconid is small with a minute hypoconulid. The hypolophid runs from the hypoconid to about halfway up the posterior slope of the protoconid. There is no cingulum.

Wear on P_2 (fig. 1) is mainly on the talonid and on the posterior slope of the protoconid; the tip of the protoconid is not worn although the enamel of the hypoconid and entoconid is worn through.

In P_4 and M_1 (fig 2) the metaconid-metastylid column is double in the unworn tooth and the cusps are separated by a faint lingual furrow which is obliterated with slight wear. In M_2 the separation apparently is lacking, because in 40497–3 (fig. 2), where M_2 is only slightly worn, there is only one rather pointed central lingual cusp. The cingulum is either continuous labially or restricted to the anterior and posterior portion of the tooth between the proto- and hypoconid.

In M_3 (fig. 2) the metaconid and metastylid are separated, but the lingual furrow is very short and is obliterated in the beginning stage of wear. The heel is short, pinched anteriorly, and slightly turned labially. There is a continuous labial cingulum.

The only upper cheek tooth is very fragmentary. The metaconule is completely submerged in the metaloph, and there is no crochet. Submersion of the metaconule occurs especially in the last molar of *Epihippus parvus* Granger and *E. gracilis*. A hypostyle is probably not developed. There is a cingulum between the proto- and hypocone, but it is lacking on the lingual walls of the cones.

Discussion.—The Texas *Epihippus* P_2 seems slightly more primitive than the same tooth in *E. intermedius* in the pointed, rather undifferentiated protoconid which rises well over the talonid, and in its small size relative to P_4. In *E. gracilis*, too, P_2 appears more advanced in these respects than the Texas specimen. The oblique valley between the proto- and hypoconid seems narrower and more closed than in *E. intermedius*, and the paralophid seems shorter. The characters mentioned and the apparent faint doubling of the central lingual column of the lower cheek teeth of *Epihippus* from the Candelaria local fauna may, however, be functions of the small size.

Epihippus intermedius is the largest species of the genus; *E. gracilis* is only slightly smaller although the type of *E. uintensis* (Marsh), synonym of

* Detailed locality data are on file at the Vertebrate Paleontology Laboratory, Texas Memorial Museum, Austin, Texas.

E. gracilis (Granger, 1908), is as large as the type of *E. intermedius*. *Epihippus parvus* is distinctly smaller than the two other forms. The measurements on P_4–M_2 from the Candelaria l.f. fall among the observations on the hypodigm of *E. gracilis*, and conform in size to a group consisting of material of that species and of *E. intermedius*.

The size and overall morphology of the lower cheek teeth of the Texas sample are similar to *Epihippus gracilis;* the specimens are also roughly equivalent in age to *E. gracilis*, making it probable that the Candelaria horse represents a southern population of this species.

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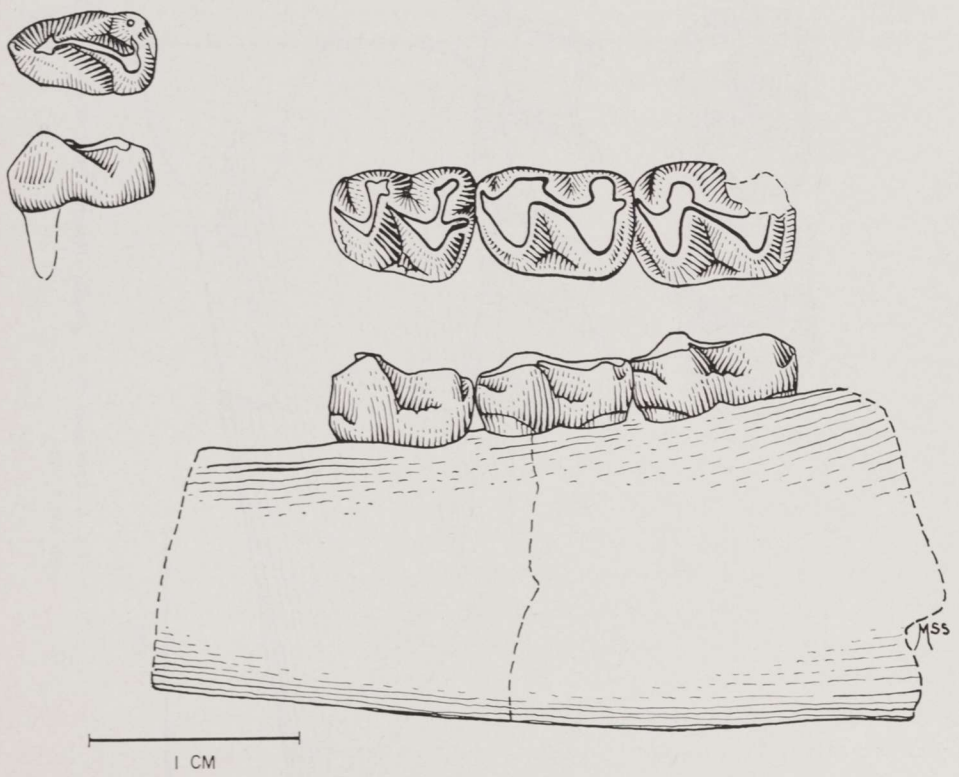

Fig. 1. *Epihippus* cf. *E. gracilis* (Marsh). TMM 40276–20. Occlusal and lateral views of left P_2 and jaw fragment with left P_4–M_2.

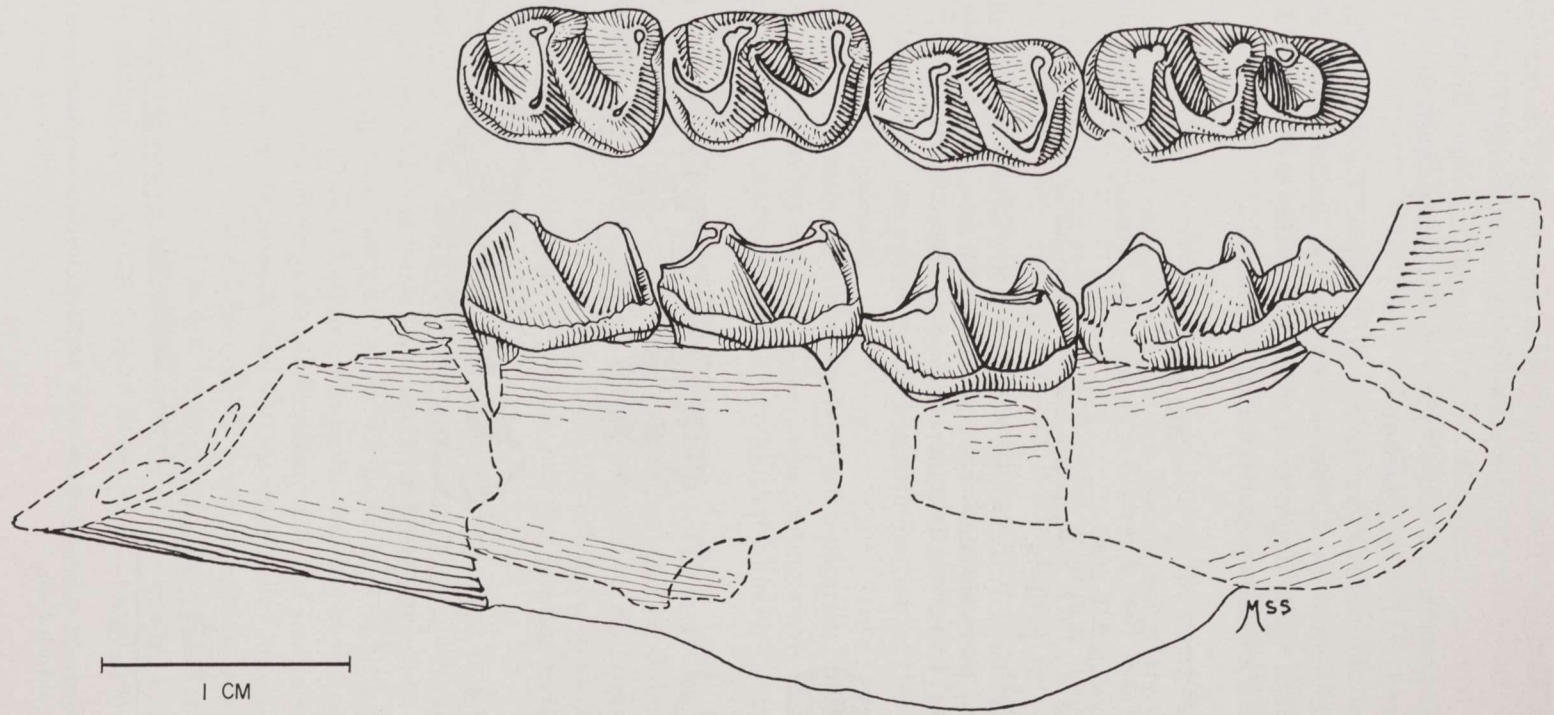

Fig. 2. *Epihippus* cf. *E. gracilis* (Marsh). TMM 40497–3. Occlusal and lateral views of jaw fragment with left P_4–M_3.

TABLE 1

MEASUREMENTS

Tooth	TMM 40276–20	40497–3	40498–4	40630–10
P_2 L	65			
ant. W	34			
post. W	38			
P_4 L	72	77		
ant. W	50	55		
post. W	56	60		
M_1 L	74	76	80	
ant. W	53	56	60	
post. W	53	54	60	
M_2 L	75	80	86	
ant. W	57	57	60	
post. W	—	56	60	
		R L		
M_3 L		117, 118	116	
ant. W		— 56	—	
post. W		52, 53	—	
M L				93@
ant. W				122@
post. W				120@

Part 2. *Mesohippus* from the Vieja Group of Texas

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INTRODUCTION

In 1948 Stovall recognized two species of horses from the Chadronian of West Texas. He referred one of them to *Mesohippus* cf. *bairdi* and the other to a "smaller species which may be new." Additional specimens were collected by the Feld Museum of Natural History in 1946. These were turned over to me for study and in 1953 *Haplohippus texanus* was described (McGrew, 1953). Description of the remaining horses in the Field Museum was delayed in hopes it could be included in a general faunal report. Subsequently, extensive collections were made by The University of Texas at Austin and the horses were sent to me for study by Dr. John A. Wilson. In the meantime, Dr. John Clark (Clark, Beerbower and Kietzke, 1967) found specimens in the Chadron Formation of the Badlands of South Dakota that he wished to refer to a species of *Mesohippus* to which I had given the manuscript name *Mesohippus viejensis*. Clark named his series of specimens *Mesohippus viejensis* with adequate description to validate the name. His syntypic series, however, were specimens from the Ahearn Member of the Chadron Formation. Thus the name *Mesohippus viejensis* must be tied to the South Dakota specimens.[1]

Clark *et al.*, (1967, p. 47) noted that two morphological groups, one significantly larger than the other, appear to be present in the West Texas collections. This has been substantiated by the additional collections and I feel that two distinct species are represented. In Clark's characterization (measurements, p. 35–36) of *M. viejensis*, however, he did not distinguish between the two groups. The Ahearn specimens (syntypic series of *M. viejensis*) are more or less intermediate between the two Texas species. Thus the smaller Texas species, the one which I had planned to name *Mesohippus viejensis*, must be given a new name.

[1] I am indebted to Dr. Hobart M. Smith of the University of Colorado and Dr. Charles A. McLaughlin of the University of Wyoming for help in interpreting the nomenclatural tangle. In a letter dated March 2, 1970, Dr. Smith expressed his opinion as follows: "Clearly *M. viejensis* is nomenclaturially occupied, and its authority is Clark and Beerbower, not McGrew, despite the apparent intent otherwise of these authors. It is not intent alone that determines the status of names, however, but the mode of expression of intent. The characterization of the name was incontrovertibly provided by Clark and Beerbower, and they are thereby unavoidably the name's authors."

Systematic Paleontology

Family Equidae

Mesohippus Marsh, 1875

Mesohippus texanus, new species

Figs. 1A,B, Table 1

Type.—FMNH PM 121, palate with L. P^1–M^2, R. P^1–M^2.

Material.—TMM 31074–6, unworn M_2; 40201–1, dP_{2-4} and M_1; 40202–2, worn P_4; 40203–6 isolated P_4 and M_1; 40203–13, two ramus fragments each with M_2; 40203–14, dP_{3-4}; 40203–10, P^{3-4}, and broken M^1; 40205–3, P_{3-4}, M_1 and M_3; 40205–5, P_4 and M_1; 40206–1, P_3–M_3;40206–26, M^3;40206–48, P_4M_2; 40410–1, M^1–M^3; 40492–10, M^{2-3}; 40492–41, P^4; 40688–36, P^3; 40688–39, M_{1-3}; 40688–40, P_2–M_3; 40688–68, dP_{2-4} and M_1; 40688–70, dP_4 and M_{1-2}; 40688–70, dP_{2-4} and M_{1-2}; 40840–45, P_{2-4}; 40206–26, M^3; 40845–1, maxillary with P^4–M^3; FMNH PM8, M^2; PM9, M^1; PM27, dP_3 and M_1; PM32, P^4;PM35, P_4–M_2; FMNH PM8, M^2; PM9, M^1; PM27, dP_3 and M_1; PM32, P^4; PM35, P_4–M_2; PM107, P_2–M_3; PM108, dP_{3-4} and M_1; PM126, M_2; PM142, fragments of two rami, one with M_2, one with M_{2-3}; PM151, M_{2-3}.

Stratigraphic position.—Chambers Tuff Formation, Vieja Group, Presidio County, Texas.* Provenir and Little Egypt local faunas (Wilson, *et al.*, 1968), Early Oligocene; an isolated locality, 40410–1 in the upper member of the Hogeye Tuff Formation of the Garren Group (Underwood, 1963; Wilson, *et al.*, 1968, fig. 2), Hudspeth County, Texas,* Early Oligocene.

Diagnosis.—Size small (see measurements); P^2_2 molariform; hypostyle absent or very weak; paraconule and metaconule distinct; lophs, particularly protolophs, poorly developed; protolophs and metalophs separated by wide, shallow valley; mesostyle weak; external ribs distinct.

Description.—Upper dentition—The upper cheek teeth of *Mesohippus texanus* n. sp. (fig. 1A) are small and low crowned for a species of the genus and can be separated from advanced species of *Epihippus* only by the molarization of P^2_2. The para- and metaconules are distinct and cuspate and only after considerable wear are complete lophs formed. The lophs are low and the valley between them shallow and wide. The paracones and metacones are separated by deep valleys. In most specimens the hypostyle is absent but in some specimens a weak hypostyle is present. P^2 is small relative to P^3. P^4 and M^1 are of nearly equal size.

Lower dentition—The lower cheek teeth fig. 1B are small and low crowned for a species of *Mesohippus*. The external cingula are variable but always weak. The hypolophid is not continuous into the metastylid until the tooth is rather heavily worn. The metaconid-metastylid separation is weak. P_2 is barely molariform and lacks a cingulum. The metalophid on P_2 is weak.

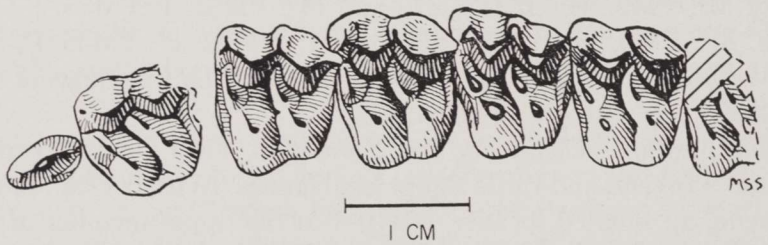
* Detailed locality data are on file at the Vertebrate Paleontology Laboratory, Texas Memorial Museum, Austin, Texas.

Discussion.—*Mesohippus texanus* is the most primitive species at present assigned to the genus. It is little advanced over *Epihippus* from the Myton, about the only significant difference being the molarization of P^2_2. It is consistently smaller than *Mesohippus viejensis* from the Ahearn of South Dakota. It also differs from *Mesohippus viejensis* in the relatively smaller P^2_2, probably a reflection of its more primitive condition and somewhat earlier age.

MESOHIPPUS SP.

Figs. 2A,B, Table 2

Material.—TMM 40203–3, M^2 and broken M^1; 40203–5, P^4_4–M_3; OU 16–4–5436a, P_3–M_3; 16–4–5436b, P_2–M_3; these two specimens appear to belong to the same individual—the teeth of both are badly cracked and are expanded; FMNH PM 42, dP_{2-4} and M_{1-2}.



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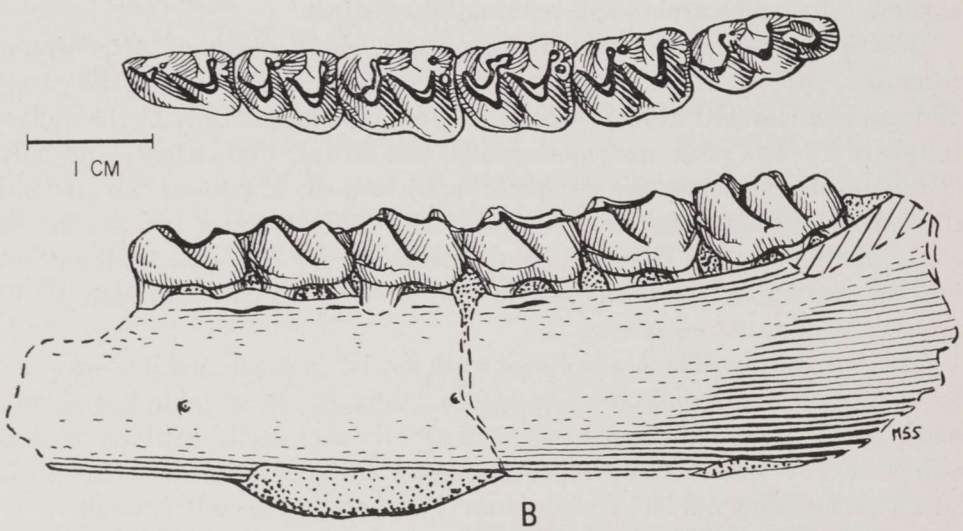

B

Fig. 1, A. *Mesohippus texanus* McGrew, new species. Type FMNH PM 121, left maxillary with P^1–M^2. B. *Mesohippus texanus* McGrew, referred specimen. FMNH PM 107, occlusal and lateral views of jaw fragment with P^2–M^3.

TABLE 1

Measurements of *Mesohippus texanus*, new species. (All measurements are in millimeters and are maximum values.)

	N	OR	M
		Upper Dentition	
P^2 L	1	9.5	9.5
W	1	9.6	9.6
Crown length, parastyle	1	6.5	6.5
Crown length, mesostyle	1	5.3	5.3
P^3 L	2	8.5–9.5	9.0
W	2	10.8–12.1	11.5
Crown length, parastyle	2	5.7 6.9	6.3
Crown length, mesostyle	2	3.6–5.1	4.4
P^4 L	6	8.7–10.7	9.5
W	6	11.6–13.1	12.5
Crown length, parastyle	5	5.4–7.6	6.6
Crown length, mesostyle	5	3.5–4.8	4.1
M^1 L	5	8.4–9.9	9.0
W	5	11.6–13.0	12.7
Crown length, parastyle	4	5.0–6.7	6.1
Crown length, mesostyle	3	4.5–4.8	4.7
M^2 L	6	8.6–9.5	8.9
W	6	12.1–12.8	12.4
Crown length, parastyle	4	5.3–6.7	6.0
Crown length, mesostyle	4	3.7–4.3	4.1
M^3 L	6	8.4–9.5	8.7
W	6	11.5–12.8	12.1
Crown length, parastyle	5	5.0–6.4	5.9
Crown length, mesostyle	5	3.4–3.9	3.6
		Lower Dentition	
	N	OR	M
P_2 L	2	5.6–7.5	6.5
W	2	5.1–5.4	5.2
Crown length, entoconid	2	3.8–4.1	3.9
P_3 L	6	8.3–9.5	8.8
W	6	6.4–7.0	6.8
Crown length, entoconid	6	2.8–5.1	3.9
P_4 L	9	7.7–9.6	9.0
W	9	6.4–7.8	7.3
Crown length, entoconid	9	2.6–6.2	4.3
M_1 L	17	8.2–10.0	9.0
W	17	6.3 7.4	6.8
Crown length, entoconid	17	2.4–7.4	4.9
M_2 L	14	7.5–10.1	8.8
W	13	6.3–7.1	6.8
Crown length, entoconid	13	2.1–5.6	4.6
M_3 L	6	10.3–12.0	11.1
W	5	5.8–6.2	6.1
Crown length, entoconid	6	3.4–5.9	4.8

Stratigraphic position.—Chambers Tuff Formation, Vieja Group, Presido County, Texas, Porvenir local fauna, Early Oligocene.

Discussion.—These specimens were found in the same horizon as *Haplohippus texanus* and *Mesohippus texanus.* They are significantly larger than the latter and the external cingula are consistently stronger. I do not believe these specimens can safely be referred to *Mesohippus viejensis* from the Ahearn of South Dakota because they seem altogether too large (fig. 8). Although a distinct species is probably represented, I consider the material at hand inadequate for proper definition of a new species.

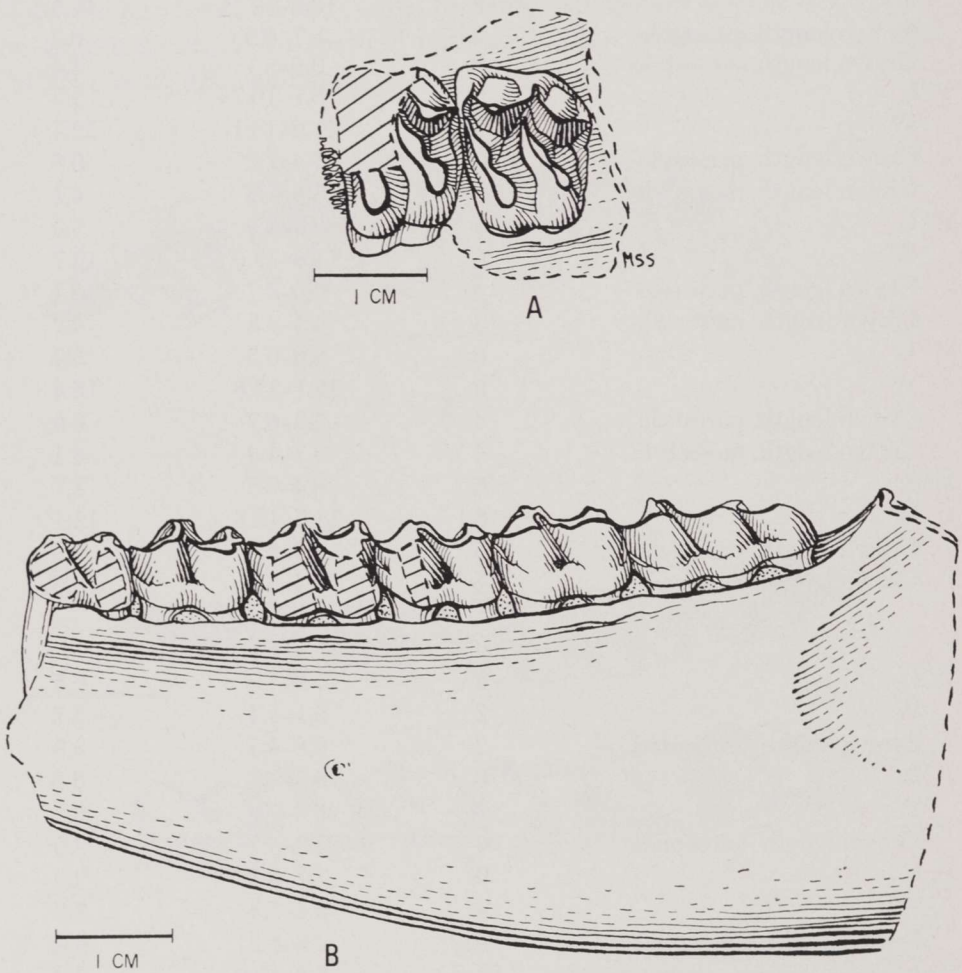

Fig. 2. A. *Mesohippus* sp. TMM 40203–3. Left maxillary fragment with M^{1-2}. B. *Mesohippus* sp. OU 16–4–5436b. Left jaw fragment with P_2–M_3.

TABLE 2

Measurements of *Mesohippus* sp. from the Vieja Group.

Upper dentition:

TMM 40203–3, M^2, L 11.7 mm, W 14.6 mm.

Lower dentition:

	TMM 40203–5	FMNH PM42	OU 16 4–5436a
P_2 L		dP_2 12.8	
W		dP_2 7.1	
P_3 L		dP_3 12.0	
W		dP_3 8.0	
P_4 L	10.5	pP_4 11.3	
W	8.3	dP_4 8.8	
M_1 L	11.1	11.8	
W	8.4	8.9	
M_2 L	11.5	13.0	
W	8.6	8.7	
M_3 L	15.0		15.3
W	8.1		8.3

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Part 3. Comparison of Populations of *Mesohippus* from Trans-Pecos Texas and Big Badlands, South Dakota

ANN-MARIE FORSTEN

INTRODUCTION

I compared the Texas sample of *Mesohippus* in the Texas Memorial Museum with Chadronian samples from the Big Badlands of South Dakota in the Field Museum of Natural History in Chicago and the Carnegie Museum at Pittsburgh. McGrew (1971) points out that there are two forms of different size represented in the Texas sample. This is also true for the samples from the Big Badlands (Forsten, 1970b). The small form from the Chambers Tuff of the Vieja Group, which McGrew calls *Mesohippus texanus*, and the large form from the Big Badlands do not have equivalents in the other fauna, but there are similarities between the larger *Mesohippus* sp. from Texas and the smaller species from South Dakota, which I regard as *Mesohippus bairdi*.

METHODS

I have used the same methods for comparison as Clark *et al.*, (1967) used in their discussion of Lower Oligocene *Mesohippus*. Thus I used the same scale of strength or degree of development of the morphological characters which they applied to their material, but added 0 for teeth lacking a cingulum. Instead of only one measurement of the breadth of the teeth (W of Clark *et al.*, 1967) I have taken two: anterior and posterior breadth. The reason for adding one more measurement to the data is that especially in the lower cheek teeth there is a clear difference between P_{3-4} and M_{1-2} in the location of maximum breadth. In the premolars this is posteriorly measured at the metastylid-entoconid-hypoconid, and in the molars anteriorly, measured at the parastylid-metaconid-protoconid. In the premolars the difference between anterior and posterior breadth is considerable; in the molars these measurements are almost equal. The difference in proportions appears to be a good criterion for separating the two categories among isolated teeth; the deciduous teeth, which resemble the molars in proportions, were separated on the basis of length to breadth.

In the upper teeth this difference is not noticeable, but both breadth measurements were taken. Because the isolated permanent teeth could not be identified as to position with any certainty, upper P^{3-4} and M^{1-3} were lumped when I calculated the statistics. In tooth rows *in situ* a slight differ-

ence in strength of development of the cingulum was noticed between premolars and molars.

I measured length along the ectoloph and height from the neck of the tooth to the top of the mesostyle and metastylid. Length and breadth were measured at the base of the tooth, including the cingulum.

Teeth were measured with a vernier caliper with an accuracy of 1/10 of a millimeter. Measurements are given in centimeters. A probability of 0.05 or less was considered as indicating a statistically significant difference between samples.

Scale of grades of morphological characters (according to Clark *et al.*, 1967):

The cingulum:	The metaconule:
0 Cingulum absent	1 Completely separate
1 one cone present, but does not close valley	2 part of metaloph, but large and round
2 closes valley but not on tooth walls	3 slight swelling on metaloph
3 complete	4 absent

Mesohippus texanus is the smallest species of *Mesohippus*. In size of the teeth it overlaps *Epihippus* from the Uintan Candelaria local fauna of the Colmena Tuff Formation, Texas. The size of *Mesohippus texanus* also overlaps the size of *Mesohippus bairdi* from the Chadron Fm. of the Big Badlands. This overlap is only partial, however, and the mean for each variate in *Mesohippus texanus* seldom reaches even the smallest observed value for the same variate in *Mesohippus bairdi*.

The value of the cofficient of regression (b) of breadth to length of the cheek teeth in *Mesohippus texanus* is high for the upper, but low for the lower teeth (table 4). In *Mesohippus bairdi* from the lower Chadron, Ahearn Member, in the Big Badlands, b for all categories of teeth is high (Forsten, 1970b), and I concluded earlier (Forsten, 1970a) that increase of breadth as compared to increase of length of the teeth was probably rapid in ancestral *Mesohippus*. In most samples, however, b varies in different tooth categories and in local samples. For all measurements compared, *Mesohippus texanus* seems to be on an extension of the same line as are my samples of *Mesohippus bairdi*.

The small size of *Mesohippus texanus* as reflected in the size of the teeth is probably a primitive feature, as is the lack of a hypostyle which in a few specimens is developed as a small style behind the metaconule, but in most upper teeth occurs only as a slight swelling of the posterior tooth wall. The lack of a crochet is also primitive. In samples of South Dakota *Mesohippus bairdi* the crochet occurs in a low number of teeth. The metaconule (table 1) of *Mesohippus texanus* is slightly more primitive, *i.e.*, more discreet than in *Mesohippus bairdi*, but the samples do not differ in the development of the cingulum (tables 2, 3).

McGrew's (1971) *Mesohippus* sp., the larger form from Chambers Tuff Fm. is scantily represented. The small sample of teeth compares rather well with *Mesohippus bairdi*, and the measurements fall inside the range of this species. The hypostyle is, as in *Mesohippus texanus*, only a thickening of the posterior wall, and in one milk tooth it occurs as a small style behind the metaconule. I did not observe a crochet.

Mesohippus texanus might represent a form of *Mesohippus* close to *Epihippus*, and it possibly evolved *in situ* from a local population of that genus. Except in size, there is a good morphological correspondence between *Mesohippus texanus* and *Epihippus* from the Candelaria local fauna. Only one very fragmentary upper cheek tooth of the earlier genus has been found, thus the stage of molarization of P^2 is unknown. In *Mesohippus texanus* P_2 is fully as molarized as in younger forms of the genus. Lower P_2 of Candelaria *Epihippus* is indistinguishable from *Mesohippus*, except that it is very small. A surprising feature of *Mesohippus texanus* is that the breadth of the trigonid of P_{3-4} (anterior breadth) is greater relative to the breadth of the talonid (posterior breadth) than in Chadron *Mesohippus bairdi*. The increase of breadth of the trigonid compared to the talonid is slow, whereas in *Mesohippus bairdi* the breadth of the trigonid increases relatively more rapidly than the breadth of the talonid. *Epihippus* and *Mesohippus* sp. from Texas are in this respect similar to *Mesohippus texanus*. In P_2, the lower molars, and in the upper cheek teeth there is no such difference in breadth of the tooth halves.

TABLE 1

Development of the metaconule, *Mesohippus texanus*.

Scale of strength	P^2 Frequency	dP^2	P^{3-4} Frequency	dP^3–dP^4	M^{1-2} Frequency	M^3
1	--	--	6	--	3	--
2	3	1	9	7	18	3
3	--	--	--	--	2	4
4	--	--	--	--	--	1

TABLE 2

Development of the cingulum, upper cheek teeth.

Scale of strength	P^2 Frequency	dP^2	P^{3-4} Frequency	dP^3–dP^4	M^{1-2} Frequency	M^3
0	1	--	1	4	10	1
1	--	--	6	--	7	3
2	--	1	3	--	3	1
3	--	--	2	3	1	4

TABLE 3

Development of the cingulum, lower cheek teeth

Scale of strength	P_2 Frequency	dP_2	P_{3-4} Frequency	dP_3–dP_4	M_{1-2} Frequency	M_3
0	1	2	0	1	--	--
1	1	1	--	--	2	0
2	--	1	4	4	5	3
3	2	4	26	22	42	10

TABLE 4

Values of coefficients of correlation and regression.

Upper P^3–M^2 length/ anterior breadth	N 23	r .59	b 1.79
Upper P^3–M^2 length/ posterior breadth	25	.55	1.32
Lower P_{3-4} length/ anterior breadth	23	.44	0.89
Lower P_{3-4} length/ posterior breadth	19	.47	1.09
Lower M_{1-2} length/ anterior breadth	38	.34	0.69
Lower M_{1-2} length/ posterior breadth	35	.27	0.79

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